# PATENT ABSTRACTS OF JAPAN

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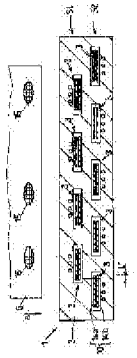
(54) MAGNETIC SENSOR



(57)Abstract:
PROBLEM TO BE SOLVED: To provide a magnetic sensor capable of reading magnetism in the whole range of a detection range, heightening the magnetic pattern detection sensitivity even if a magnetic pattern array is changed, and preventing generation of a cross talk.

SOLUTION: Element rows S1, S2 formed by arraying a plurality of magnetic resistance elements 3 along the crossing direction at a prescribed angle with the passing direction of an analyte 6 having the magnetic pattern 15 are installed in the shifted state in the passing direction of the analyte 6. Each magnetic resistance element 3 in one element row has an array form wherein its magnetic induction region 10 overlap that of the magnetic resistance element 3 in the other element row in the passing direction of the analyte 6 so that the whole region where the analyte 6 passes becomes the magnetic induction region in the array direction of the magnetic resistance elements 3.

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LEGAL STATUS

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CLAIMS

[Claim(s)]

[Claim 1] Each magnetic resistance element [ in / the element array which arranged two or more magnetic resistance elements along the direction which crosses at a predetermined include angle to the passage direction of the analyte which has a magnetic pattern is shifted in the passage direction of said analyte, and / in two or more successive installation **** / said one element array ] is a magnetometric sensor with which it is characterized by what is considered as the array gestalt with which a magneto induction field laps mutually towards said analyte passing to the magnetic resistance element in other element arrays.

[Claim 2] The magneto induction field of each of each magnetic resistance element [ in / in a magnetometric sensor according to claim 1, said element arrays are two trains, and / one side of the element array of said two trains ] and the magneto induction field of each of each magnetic resistance element in another side of the element array of said two trains are a magnetometric sensor characterized by what is considered as the array gestalt which laps mutually in the direction through which said analyte passes.

[Claim 3] It is the magnetometric sensor characterized by what said magnetometric sensor has the case in the magnetometric sensor according to claim 1 or 2, two or more individual receipt slots which contain two or more magnetic resistance elements of each which constitute said each element array in said case according to an individual are prepared, and each magnetic resistance element of each of said element array is contained for by said receipt slot classified by each.

[Claim 4] It is the magnetometric sensor according to claim 1 characterized by what said magnetometric sensor has the case in the magnetometric sensor according to claim 1 or 2, the common receipt slot which carries out the common receipt of two or more magnetic resistance elements which constitute each element array for said every element array in said case is prepared, and each magnetic resistance element of each of said element array is contained for by said each of each common receipt slot.

[Claim 5] The predetermined include angle which the direction where a magnetic resistance element is arranged with said element array in a magnetometric sensor given in either of claims 1-4, and the passage direction of said analyte cross is a magnetometric sensor characterized

by what is been a rectangular cross or the include angle which intersects perpendicularly mostly.

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[Translation done.]

* NOTICES *



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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to a magnetometric sensor and relates to the magnetometric sensor with which two or more magnetic resistance elements are arranged along the direction which crosses at a predetermined include angle in more detail to the passage direction of the analyte by which magnetic detection is carried out, for example, the direction which intersects perpendicularly.
[0002]
[Description of the Prior Art] With reference to drawing 7 , a magnetometric sensor 1 and the magnetic card 6 as analyte which should be detected by this magnetometric sensor 1 are explained.
[0003] A magnetic card 6 has two or more magnetic patterns 15 which corresponded to the longitudinal direction of the detection side of a magnetometric sensor 1 so that it might meet in what was illustrated to drawing 7 . This magnetic pattern 15 is equivalent to the data recorded on a magnetic card 6.
[0004] A magnetometric sensor 1 has two or more magnetic resistance elements 3 which have similarly arranged said magnetic pattern 15 possible [ reading ] along with the longitudinal direction of the detection side.
[0005] the time of a magnetic card 6 moving in the direction of arrow-head a of drawing 7 , approaching a magnetometric sensor 1, and passing through the detection side top -- each magnetic resistance element 3 of

a magnetometric sensor 1 -- each -- each magnetic pattern 15 of a magnetic card 6 -- it is alike, respectively, magneto induction is carried out individually, and the detection output corresponding to the magneto induction is outputted. Each detection output of a magnetometric sensor 1 is given to the processing circuit which is not illustrated [ which carries out signal processing ], and the record data of a magnetic card 6 are processed by this.

[0006] Array spacing of each magnetic pattern 15 in such a magnetic card 6 and each magnetic resistance element 3 in a magnetometric sensor 1 is made predetermined relation, and it enables it to detect the data currently recorded on the magnetic card 6 with the gestalt of the magnetic pattern 15 with a magnetometric sensor 1.

[0007] When spacing between ****** magnetic resistance elements was large and change arises at array spacing of the magnetic pattern 15 in a magnetic card 6, correspondence relation with the magnetic resistance element 3 in the magnetic pattern 15 and magnetometric sensor 1 is broken down, and it becomes impossible for a magnetometric sensor 1 to detect the magnetic pattern 15 of a magnetic card 6 correctly in such structure.

[0008] Then, the applicant for this patent has already proposed the magnetometric sensor which can detect each magnetic pattern certainly in JP,5-332703,A, even if array spacing of a magnetic pattern is changed in this way.

[0009] As drawing 7 shows, near the center section of the whole surface used as the detection side of a case 2, this magnetometric sensor forms the long slot 20 where a long side meets in a case 2 and this direction, and arranges and consists of gestalten which adjoin each other so that this long slot 20 may be mutually contacted on the direction straight line of a long side in two or more magnetic resistance elements 3.

[0010] In arranging so that spacing of the magneto induction section 10 in each adjacent magnetic resistance elements 3 and 3 and ten comrades may become narrower than the width of face of the magnetic pattern 15 at this time, even if the magnetic pattern of a magnetic card is changed, it is expectable to detect that magnetic pattern.

[0011]

[Problem(s) to be Solved by the Invention] By the way, in order that an applicant for this patent might aim at amelioration of the above-mentioned magnetometric sensor, he repeated research further and found out the technical problem explained below about the magnetometric sensor.

[0012] As drawing 4 shows, the magneto induction section 10 of each magnetic resistance element 3 used for the above-mentioned magnetometric

sensor 1 is installed in a longitudinal direction side by side, where series connection of two or more unit magnetic force sencors j is carried out, it constitutes the admiration magnetic body trains 14a and 14b, further, separates predetermined spacing mutually forward and backward, and forms the pair of these admiration magnetic body trains 14a and 14b on a substrate 17.

[0013] However, in each magnetic resistance element 3, as shown in drawing 4 , since there is no structure which carries out a magnetosensitive **** magnetoelectric conversion, in the field between the edge in the longitudinal direction of the magneto induction section 10, and the edge section in the longitudinal direction of a substrate 17, the field is the non-[ magnetic ] influence field L which cannot detect the magnetic pattern 15.

[0014] Therefore, when this magnetic resistance element 3 is arranged by the longitudinal-direction single tier like the above-mentioned magnetometric sensor, the non-[ magnetic ] influence field L of the non-[ magnetic ] influence field L of a magnetic resistance element 3 (for example, a non-[ magnetic ] influence field is generated by die length of about 125 micrometers), this magnetic resistance element 3, and the adjacent magnetic resistance element 3 will be totaled, and the fairly big non-[ magnetic ] influence field H (refer to drawing 7 ) will be formed.

[0015] On the other hand, modification of the correspondence physical relationship of array spacing of the magnetic pattern 15 of a magnetic card 6, and a magnetic pattern and a magnetic resistance element 3 generates what shifts to the broken-line location which does not carry out a right pair from the continuous-line location as for which the location of the magnetic pattern 15 in a magnetic card 6 carries out a right pair to the magneto induction section 10, for example, as shown in drawing 7 . Consequently, there is a possibility that the detection output of the magnetic pattern by the magnetometric sensor may decline, and detection sensibility may become low.

[0016] Moreover, when it approaches so that it may straddle between the magnetic resistance elements to which a magnetic pattern adjoins a longitudinal direction since the magnetic resistance element is arranged by the longitudinal direction single tier of a detection side in the case of this magnetometric sensor, the so-called cross talk with which the detection output to the same magnetic pattern is given to coincidence from each of both magnetic resistance elements in a magnetic-card data-processing circuit occurs, and fault is caused to processing of the record data of the magnetic card in this processing

circuit.
[0017] Therefore, this invention makes it for magnetic pattern detection sensibility to be raised and to make it said cross talk not occur, even if it makes reading of the MAG possible in all the range of the detection range and there is array modification of a magnetic pattern the technical problem which should be solved in the magnetometric sensor.
[0018]
[Means for Solving the Problem] This invention is characterized by shifting the element array which arranged two or more magnetic resistance elements along the direction which crosses at a predetermined include angle to the passage direction of the analyte which has a magnetic pattern in the passage direction of said analyte, and making each magnetic resistance element in said one element array into the array gestalt with which a magneto induction field laps mutually with two or more successive installation **** towards said analyte passing to the magnetic resistance element in other element arrays.
[0019] The magneto-induction field of each of each magnetic resistance element in the element array of two or more trains which have been shifted and arranged in the passage direction of analyte according to this invention can detect the magnetic pattern, even if it compares and array spacing of the magnetic pattern of analyte is changed, since all the fields through which are considering as the array gestalt which laps mutually in the direction through which analyte's passes, and analyte passes in the array direction of a magnetic resistance element turn into a magneto-induction field. It seems that therefore, neither the fall of a detection output nor the fall of detection sensibility is caused.
[0020] Moreover, since said each element array is predetermined ****** carried out to said detection direction and is prepared, it is lost that the cross talk with which the magnetic resistance element of each element array detects analyte to coincidence occurs, and detection of a magnetic pattern can be ensured.
[0021] This invention is desirable, said element arrays are two trains and the magneto induction field of each of each magnetic resistance element in one side of the element array of said two trains and the magneto induction field of each of each magnetic resistance element in another side of the element array of said two trains are made into the array gestalt which laps mutually in the direction through which said analyte passes.
[0022] In this case, even if array spacing of the magnetic pattern of analyte is changed, while that magnetic pattern is certainly detectable and becoming structurally easy, it can constitute from element arrays

being two trains in a compact.
[0023] This invention is desirable, said magnetometric sensor has the case, two or more individual receipt slots which contain two or more magnetic resistance elements of each which constitute said each element array according to an individual are established in said case, and each magnetic resistance element of each of said element array is contained by said receipt slot classified by each.
[0024] This invention is desirable, said magnetometric sensor has the case, the common receipt slot which carries out the common receipt of two or more magnetic resistance elements which constitute each element array is established in said case for said every element array, and each magnetic resistance element of each of said element array is contained by said each of each common receipt slot.
[0025] The predetermined include angle which this invention is desirable and the direction where a magnetic resistance element is arranged with said element array, and the passage direction of said analyte cross is a rectangular cross or an include angle which intersects perpendicularly mostly.
[0026]
[Embodiment of the Invention] Hereafter, it explains based on the gestalt of the operation which shows the detail of this invention to a drawing.
[0027] The sectional view where the sectional view where drawing 1 thru/or drawing 4 start the operation gestalt of this invention, drawing 1 meets the perspective view of the magnetometric sensor of the gestalt of this operation, and drawing 2 meets the A-A line of drawing 1 , and drawing 3 meet the B-B line of drawing 1 , and drawing 4 are the top views of a magnetic resistance element.
[0028] With reference to drawing 1 thru/or drawing 4 , the magnetometric sensor 1 of the gestalt of this operation has the case 2 of a long mold, two or more magnetic-resistance-element 3 --, and the metal covering 4 and the permanent magnet 5 for bias.
[0029] A case 2 has a long picture configuration to the direction through which the magnetic card 6 as analyte passes in a rectangular cross or the direction (the array direction mentioned later) which intersects perpendicularly mostly. Two or more magnetic-resistance-element receipt slots 7 are established in the whole surface of a case 2, and receipt immobilization of the magnetic resistance element 3 is carried out in this receipt slot 7, respectively. The depth of this magnetic-resistance-element receipt slot 7 is made deeper than the component thickness of a magnetic resistance element 3.

[0030] a case 2 -- on the other hand, the permanent magnet receipt slot 8 is established in a side, and receipt immobilization of the permanent magnet 5 single into this receipt slot 8 is carried out.
[0031] The whole surface side of a case 2 is covered with the metal covering 4. Furthermore, two or more terminal pins 9 are transfixed to the case 2.
[0032] As shown in drawing 4 , it has the magneto induction section 10 inside, and the terminals 11 and 13 for I/O are connected to each of both ends of that magneto induction section 10 through a connection electrode, the middle terminal 12 is connected also to the electrode which makes middle connection, three terminals 11, 12, and 13 each position said both connection electrode in detection direction one side for every magnetic resistance element 3, and this magnetic resistance element 3 is **********.
[0033] If it explains in full detail, as the magneto induction section 10 is shown in drawing 4 , it is prepared in the condition that the magnetic force sencors 14a and 14b of two trains carry out phase opposite, said terminals 11 and 12 are connected to the both ends of one magnetic force sencor 14a, respectively, said terminal 13 is connected to the end of magnetic force sencor 14b of another side, and said terminal 12 is connected to the other end of magnetic force sencor 14b of another side.
[0034] And the lead terminals 16, 17, and 18 connected to each terminals 11, 12, and 13 are connected to said terminal pin 9 prepared in the case 2, respectively.
[0035] this -- this magnetometric sensor 1 -- two or more magnetic resistance elements 3 -- respectively -- since -- the detection output of the magnetic information from the magnetic card 6 as analyte is obtained according to an individual.
[0036] In the above configuration, it has the description in the next configuration with the gestalt of this operation. That is, with the gestalt of this operation, two or more magnetic-resistance-element receipt slots 7 are shifted to predetermined spacing by ****** 2 train, and a location is alternately carried out in the direction which intersects perpendicularly to the direction over the magnetometric sensor 1 of a magnetic card 6 through which it passes, and they are established in it. And it sets alternately, and the magnetic-resistance-element receipt slot 7 of each train is formed so that a magnetic card 6 may lap in the following relation in said direction which passes through the detection side top of a magnetometric sensor 1.
[0037] that is, it is shown in drawing 1 and drawing 2 -- as -- the

magnetic-resistance-element receipt slot 7 of each element array -- said two or more magnetic resistance elements 3 by being alike, respectively and containing the magnetic resistance element 3 As opposed to each magneto induction section 10 and 10 two magnetic resistance elements 3 and 3 in [ in / it is divided into two element arrays S1 and S2, respectively that it is also at the magnetic resistance element of a predetermined number, and / each element arrays S1 and S2 ] one element array S1 -- It considers as the array gestalt with which the magneto induction section 10 of the magnetic resistance element 3 in the element array S2 of another side laps in the direction (direction which the arrow head a in drawing 2 shows) in which it passes a magnetometric sensor 1 since a magnetic card 6 is detection of the magnetic pattern 15.

[0038] Here, as drawing 4 shows a magnetic resistance element 1, the magneto induction section 10 is formed along said predetermined direction on the necessary substrate 19, and the field between the both-ends edge in said predetermined direction of a substrate 19 and each longitudinal direction both-ends edge of the magneto induction section 10 is the non-[ magnetic ] influence field L. Moreover, the opposite distance of both the magneto induction section of the magnetic resistance element which adjoins each other in the predetermined direction [ in each element array ] is set below to the detection die length (that is, the die length of the range in which the magnetic pattern 15 is formed) of the magnetic card 6 as analyte. Here, the magneto induction section 10 shows a magneto induction field.

[0039] two magnetic resistance elements [ in / moreover / one element array S1 ] 3 and 3 -- it considers as the array gestalt with which the magneto induction section 10 of the magnetic resistance element 3 in the element array S2 of another side laps in the direction which passes the magnetometric sensor 1 of a magnetic card 6 to each magneto induction section 10 and 10.

[0040] Therefore, in the case of the magnetometric sensor 1 concerning the gestalt of this operation, a magnetic resistance element 3 adjoins each other in the predetermined direction, and two or more arrangement is carried out. Even if a big non-[ magnetic ] influence field is formed in the predetermined direction concerned of those non-[ magnetic ] influence fields and array spacing of the magnetic pattern 15 is changed by the magnetic-card 6 side To the magneto induction section 10 of each of two magnetic resistance elements in one element array according to the array gestalt with which the magneto induction section 10 of the magnetic resistance element in the element array of another side laps to the passage direction of said magnetic card 6 In the whole breadth range

through which the magnetic pattern 15 of a magnetic card 6 passes, since there is no field which cannot detect the magnetic pattern 15, the magnetic pattern 15 is detectable with a certainly sufficient precision. It seems that neither the fall of a detection output nor the fall of detection sensibility is caused even when field L' with which each train S1 and the magneto induction section 10 between S2 lap especially is on a detection pattern.

[0041] Moreover, since said each element arrays S1 and S2 are predetermined ****** carried out to said passage direction of a magnetic card 6 and are prepared, it is lost that the cross talk with which the magnetic resistance element 3 of each element arrays S1 and S2 detects analyte to coincidence occurs, and detection of the magnetic pattern 15 can be ensured.

[0042] This invention is not limited to an above-mentioned operation gestalt, and can consider various application and deformation.

[0043] (1) In the case of the above-mentioned operation gestalt, the magnetic-resistance-element receipt slot was an individual receipt slot which contains each of each magnetic resistance element according to an individual, but The common receipt slot 20 which carries out the common receipt of two or more magnetic resistance elements 3 which constitute one element array as drawing 5 shows, The common receipt slot 21 which carries out the common receipt of each makes a longitudinal direction carry out a predetermined distance location gap, and is established in it. two or more magnetic resistance elements 3 which constitute the element array of said another side -- said each common receipt slots 20 and 21 -- respectively -- alike -- the magnetic resistance element 3 of each of said element arrays S1 and S2 -- each may be contained. In this case, while having contained so that a magnetic resistance element 3 may contact mutually [ ****** things do not have a spacer etc. and ] in each element arrays S1 and S2 Because the common receipt slots 20 and 21 are carrying out the predetermined distance location gap by the longitudinal direction The magneto induction section 10 which serves as a magneto induction field of the magnetic resistance element 3 of an element array S1 in the passage direction in case analyte moves in the direction of arrow-head a and the magnetometric sensor 1 is passed for magnetic detection, Since the magneto induction section 10 used as the magneto induction field of the magnetic resistance element 3 of an element array S2 laps, the field which cannot carry out magnetic detection in the passage field of the analyte in the direction in which the magnetic resistance element 3 is arranged is lost, and can improve [ precision ] magnetic detection.

[0044] (2) In the case of the above-mentioned operation gestalt, for the case of a magnetometric sensor to serve as a long picture, but what is necessary is just the case which does not need to be limited to this and can contain a magnetic resistance element.
[0045] (3) Although a magnetic resistance element is arranged in the direction which intersects perpendicularly to the passage direction of analyte in the case of an above-mentioned operation gestalt and the element array is constituted, it may cross at the predetermined include angle which the need that the direction of the element array intersects perpendicularly to the passage direction of analyte does not not necessarily have, and becomes slanting to the passage direction of analyte.
[0046] (4) In the case of the above-mentioned operation gestalt, it is the gestalt by which one magnetic resistance element is contained in one magnetic-resistance-element receipt slot, but you may make it make one magnetic-resistance-element receipt slot 22 contain two or more magnetic-resistance-element 3 --, as there is not necessarily no need of making one magnetic-resistance-element receipt slot containing one magnetic resistance element, for example, drawing 6 shows. In this case, a spacer is made for a list to intervene between the ****** magnetic resistance elements 3 in the same element array between an element array S1 and S2.
[0047] (5) In the case of an above-mentioned operation gestalt, the magneto induction section 10 of each magnetic resistance element 3 used for the above-mentioned magnetometric sensor 1 For example, although what installed in the longitudinal direction side by side where series connection of two or more unit magnetic force sencors j is carried out, constituted the magnetosensitive objects 14a and 14b, separated the pair of these magnetosensitive objects 14a and 14b, and formed predetermined spacing for it on the substrate 17 mutually forward and backward further was shown as drawing 4 showed The magnetic resistance element constituted so that a magnetosensitive object might become width with 1 relation is sufficient.
[0048] (6) In the case of the above-mentioned operation gestalt, the magnetic card was shown as analyte, but it may not be limited to a magnetic card and a stick-like magnetic-recording medium etc. may be used.
[0049] (7) It is not necessary to necessarily set up the opposite distance of both the magneto induction section of the magnetic resistance element which adjoins each other in the predetermined direction [ in each element array ] in this way, and with an above-

mentioned operation gestalt, although [ distance ] set below to the detection die length of the magnetic card 6 as analyte, also when the opposite distance is longer than the detection die length of analyte, it is included in the invention in this application.
[0050]
[Effect of the Invention] Even if there are a metaphor and array modification of a magnetic pattern since non-detecting area is lost according to this invention as explained above, magnetic pattern detection sensibility is raised and reading of the MAG becomes possible in all the range of the detection range. Moreover, a cross talk can be prevented from generating.

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[Translation done.]

* NOTICES *



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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] The perspective view of the magnetometric sensor concerning the operation gestalt of this invention
[Drawing 2] The sectional view which meets the A-A line of drawing 1
[Drawing 3] The sectional view which meets the B-B line of drawing 1
[Drawing 4] The top view of a magnetic resistance element
[Drawing 5] The top view of the important section of the magnetometric sensor concerning other operation gestalten of this invention
[Drawing 6] The top view of the important section of the magnetometric sensor concerning other operation gestalten of this invention
[Drawing 7] Drawing showing the relation between a magnetic card and the conventional magnetometric sensor
[Description of Notations]
1 Magnetometric Sensor
3 Magnetic Resistance Element

6 Magnetic Card (Analyte)
10 Magneto Induction Section (Magneto Induction Field)
15 Magnetic Pattern
S1, S2 Element array

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[Translation done.]

* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

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DRAWINGS

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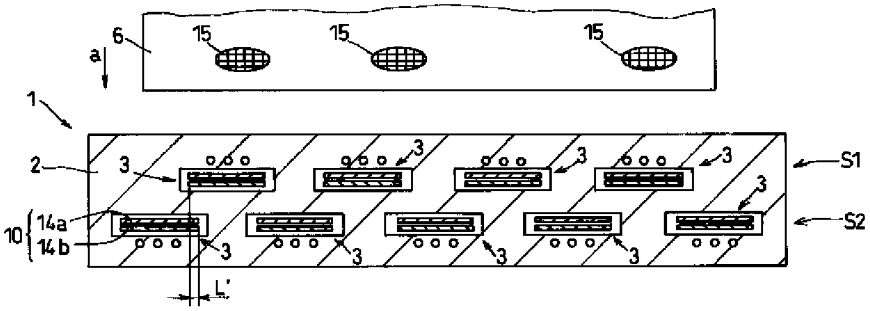
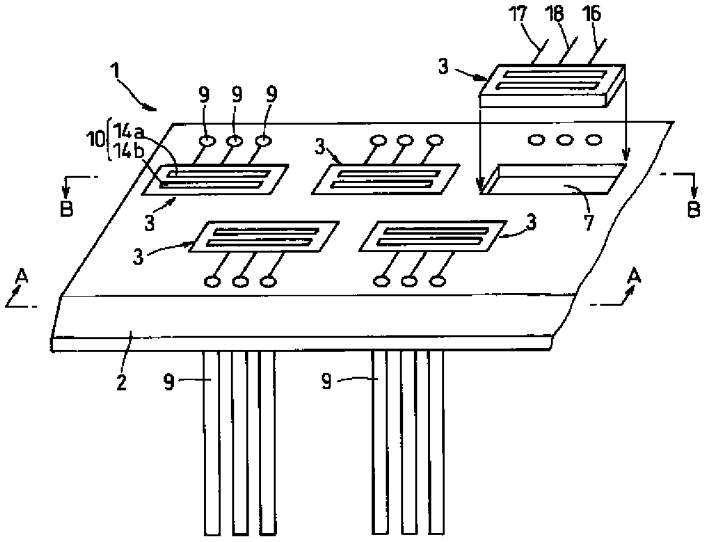
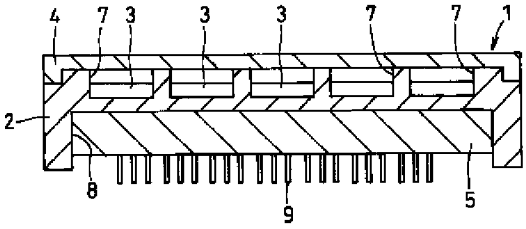
[Drawing 2]



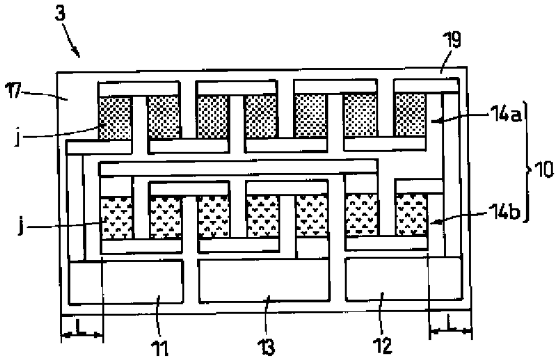

[Drawing 1]



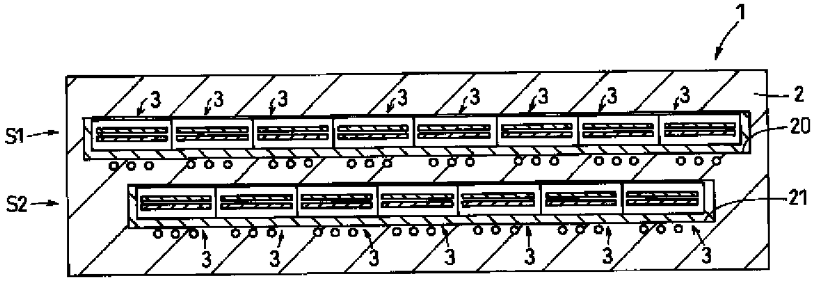

[Drawing 3]



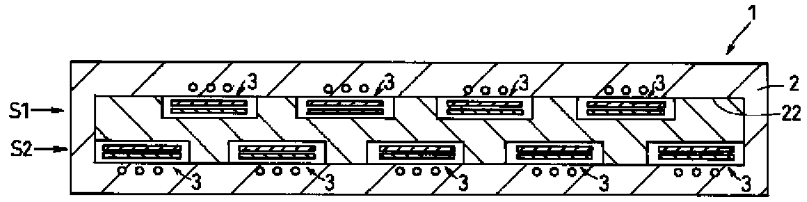

[Drawing 4]



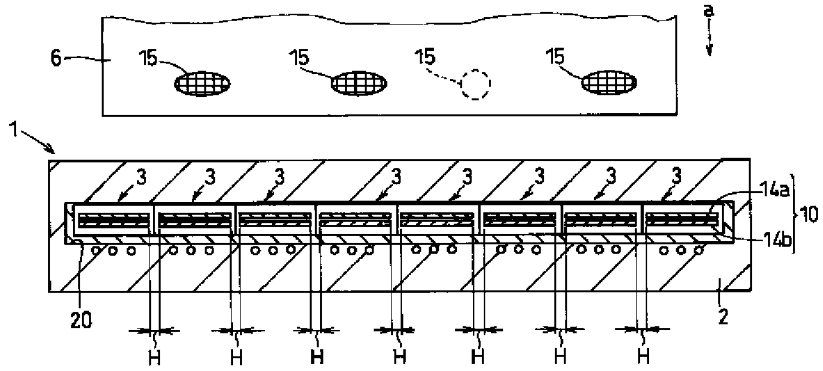

[Drawing 5]




[Drawing 6]




[Drawing 7]

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[Translation done.]

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| Ｂ４２Ｄ　15/10 | ５０１ | Ｇ０６Ｋ　17/00 | Ａ | ２Ｇ０１７ |
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| 19/06 | | 5/39 | | ５Ｂ０５８ |
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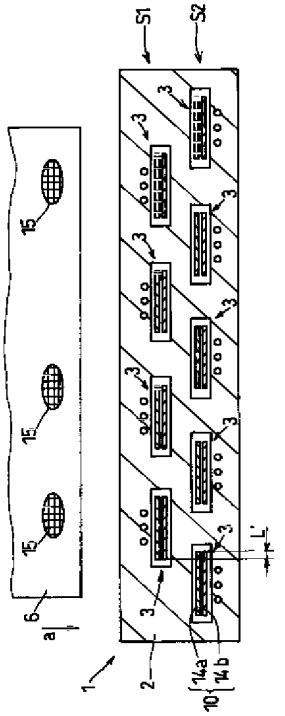
(54)【発明の名称】　磁気センサ

(57)【要約】
【課題】磁気センサにおいて、検出範囲の全範囲で磁気の読取を可能とし、磁気パターンの配列変更があっても、磁気パターン検知感度を高められ、また、クロストークが発生しないようにすること。
【解決手段】磁気パターン１５を有する被検体６の通過方向に対して所定角度で交わる方向に沿って複数の磁気抵抗素子３を配列した素子列Ｓ１，Ｓ２を、被検体６の通過方向でずらして複数列設けるとともに、磁気抵抗素子３の配列方向で被検体６の通過する全領域が磁気感応領域となるように、一つの素子列における各磁気抵抗素子３は、他の素子列における磁気抵抗素子３に対して被検体６の通過する方向で磁気感応領域１０が互いに重なる配列形態とされている。



【特許請求の範囲】
【請求項１】　磁気パターンを有する被検体の通過方向に対して所定角度で交わる方向に沿って複数の磁気抵抗素子を配列した素子列を、前記被検体の通過方向でずらして複数列設けるとともに、
一つの前記素子列における各磁気抵抗素子は、他の素子列における磁気抵抗素子に対して前記被検体の通過する方向で磁気感応領域が互いに重なる配列形態とされている、ことを特徴とする磁気センサ。
【請求項２】　請求項１に記載の磁気センサにおいて、前記素子列は二列であり、
前記二列の素子列の一方における各磁気抵抗素子それぞれの磁気感応領域と、前記二列の素子列の他方における各磁気抵抗素子それぞれの磁気感応領域とは、前記被検体の通過する方向において互いに重なる配列形態とされている、ことを特徴とする磁気センサ。
【請求項３】　請求項１または２に記載の磁気センサにおいて、
前記磁気センサはケースを有しており、
前記ケースには、前記各素子列を構成する複数の磁気抵抗素子それぞれを個別に収納する複数の個別収納溝が設けられており、前記各個別収納溝に前記各素子列の磁気抵抗素子それぞれが収納されている、ことを特徴とする磁気センサ。
【請求項４】　請求項１または２に記載の磁気センサにおいて、
前記磁気センサはケースを有しており、
前記ケースには、前記各素子列ごとに、各素子列を構成する複数の磁気抵抗素子を共通収納する共通収納溝が設けられており、前記各共通収納溝それぞれに前記各素子列の磁気抵抗素子それぞれが収納されている、ことを特徴とする請求項１に記載の磁気センサ。
【請求項５】　請求項１から４のいずれかに記載の磁気センサにおいて、
前記素子列で磁気抵抗素子の配列される方向と前記被検体の通過方向とが交わる所定角度は、直交ないしはほぼ直交する角度である、ことを特徴とする磁気センサ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、磁気センサに係り、より詳しくは、磁気検出される被検体の通過方向に対して所定角度で交わる方向、例えば、直交する方向に沿って複数の磁気抵抗素子が配列されている磁気センサに関する。
【０００２】
【従来の技術】図７を参照して、磁気センサ１と、この磁気センサ１により検知されるべき被検体としての磁気カード６とについて説明する。
【０００３】磁気カード６は、図７に例示したものにおいて、磁気センサ１の検知面の長手方向に沿うよう対応した複数の磁気パターン１５を有する。この磁気パターン１５は、磁気カード６に記録されるデータに対応する。
【０００４】磁気センサ１は、同じくその検知面の長手方向に沿って前記磁気パターン１５を読取可能に配置した複数の磁気抵抗素子３を有する。
【０００５】磁気カード６が、図７の矢印ａ方向に移動して磁気センサ１に接近し、その検知面上を通過するとき、磁気センサ１の各磁気抵抗素子３それぞれは、磁気カード６の各磁気パターン１５それぞれに個別に磁気感応し、その磁気感応に対応した検知出力を出力する。磁気センサ１の各検知出力は、信号処理する不図示の処理回路に与えられ、これによって、磁気カード６の記録データが処理される。
【０００６】このような磁気カード６における個々の磁気パターン１５と、磁気センサ１における個々の磁気抵抗素子３との配列間隔は、所定の関係にされ、磁気カード６に磁気パターン１５の形態で記録されているデータを磁気センサ１で検知できるようにされている。
【０００７】このような構造においては、隣合う磁気抵抗素子間の間隔が大きいと、磁気カード６における磁気パターン１５の配列間隔に変化が生じた場合、その磁気パターン１５と磁気センサ１における磁気抵抗素子３との対応関係が崩され、磁気センサ１は、磁気カード６の磁気パターン１５を正確に検知することができなくなる。
【０００８】そこで、本願出願人は、このように磁気パターンの配列間隔が変更されたとしても、各磁気パターンを確実に検知できる磁気センサを特開平５－３３２７０３号公報において既に提案している。
【０００９】この磁気センサは、図７で示すように、ケース２の検知面となる一面の中央部付近に、長辺がケース２と同方向に沿う長溝２０を設け、この長溝２０に複数個の磁気抵抗素子３を、長辺方向一直線上に互いに当接するよう隣り合う形態で配列して構成されている。
【００１０】このとき、隣り合う各磁気抵抗素子３，３における磁気感応部１０，１０同士の間隔が、磁気パターン１５の幅より狭くなるように配列することで、磁気カードの磁気パターンが変更されても、その磁気パターンを検知することが期待できる。
【００１１】
【発明が解決しようとする課題】ところで、本願出願人は、上記磁気センサの改良を図るため、さらに研究を重ね、その磁気センサに関して以下に説明する課題を見出した。
【００１２】上記磁気センサ１に使用される各磁気抵抗素子３の磁気感応部１０は、例えば、図４で示すように、複数個の単位感磁部ｊを直列接続した状態で左右方向に並設して感磁体列１４ａ，１４ｂを構成し、さらにこの感磁体列１４ａ，１４ｂの一対を、前後に互いに所

定間隔を隔てて基板１７上に形成したものである。
【００１３】しかしながら、図４に示すように、各磁気抵抗素子３において、磁気感応部１０の左右方向での端部と基板１７の左右方向での端縁部との間の領域には、感磁して磁電変換する構造がないことから、その領域は、磁気パターン１５の検知が行なえない磁気不感応領域Ｌとなっている。
【００１４】そのため、この磁気抵抗素子３を上記磁気センサのように左右方向一列で配置させると、磁気抵抗素子３の磁気不感応領域Ｌ（例えば１２５μｍ程度の長さで磁気不感応領域が生じる）とこの磁気抵抗素子３と隣り合う磁気抵抗素子３の磁気不感応領域Ｌとが合計されて相当に大きな磁気不感応領域Ｈ（図７参照）が形成されることになる。
【００１５】一方、磁気カード６の磁気パターン１５の配列間隔や、磁気パターンと磁気抵抗素子３との対応位置関係が変更されると、例えば、図７に示すように、磁気カード６における磁気パターン１５の位置が磁気感応部１０に正対する実線位置から正対しない破線位置にずれるようなことが発生する。その結果、磁気センサによる磁気パターンの検知出力が低下し検知感度が低くなるおそれがある。
【００１６】また、この磁気センサの場合、磁気抵抗素子が検知面の長手方向一列に配列されているから、磁気パターンが横方向に隣り合う磁気抵抗素子間にまたがるように接近した場合、両磁気抵抗素子それぞれから同一の磁気パターンに対する検知出力が同時に磁気カードデータ処理回路に与えられるいわゆるクロストークが発生し、この処理回路での磁気カードの記録データの処理に不具合を来たす。
【００１７】したがって、本発明は、磁気センサにおいて、検出範囲の全範囲で磁気の読取を可能とし、磁気パターンの配列変更があっても、磁気パターン検知感度を高められ、また、前記クロストークが発生しないようにすることを解決すべき課題としている。
【００１８】
【課題を解決するための手段】本発明は、磁気パターンを有する被検体の通過方向に対して所定角度で交わる方向に沿って複数の磁気抵抗素子を配列した素子列を、前記被検体の通過方向でずらして複数列設けるとともに、一つの前記素子列における各磁気抵抗素子は、他の素子列における磁気抵抗素子に対して前記被検体の通過する方向で磁気感応領域が互いに重なる配列形態とされていることを特徴とする。
【００１９】本発明によると、被検体の通過方向でずらして配置された複数列の素子列における各磁気抵抗素子それぞれの磁気感応領域は、被検体の通過する方向において互いに重なる配列形態とされていることで、磁気抵抗素子の配列方向で被検体が通過する全領域が磁気感応領域となるから、例え、被検体の磁気パターンの配列間隔が変更されても、その磁気パターンを検知できる。したがって、検知出力の低下や検知感度の低下を来たすようなことがない。
【００２０】また、前記各素子列が前記検知方向に対して所定距離ずらされて設けられているから、各素子列の磁気抵抗素子が同時に被検体を検知するクロストークが発生するようなことがなくなり、磁気パターンの検知を確実に行うことができるようになる。
【００２１】本発明は、好ましくは、前記素子列は二列であり、前記二列の素子列の一方における各磁気抵抗素子それぞれの磁気感応領域と、前記二列の素子列の他方における各磁気抵抗素子それぞれの磁気感応領域とは、前記被検体の通過する方向において互いに重なる配列形態とされている。
【００２２】この場合、素子列が二列であることで、被検体の磁気パターンの配列間隔が変更されても、その磁気パターンを確実に検出できるものでありながら、構造的に簡単なものとなるとともに、コンパクトに構成できる。
【００２３】本発明は、好ましくは、前記磁気センサはケースを有しており、前記ケースには、前記各素子列を構成する複数の磁気抵抗素子それぞれを個別に収納する複数の個別収納溝が設けられており、前記各個別収納溝に前記各素子列の磁気抵抗素子それぞれが収納されている。
【００２４】本発明は、好ましくは、前記磁気センサはケースを有しており、前記ケースには、前記各素子列ごとに、各素子列を構成する複数の磁気抵抗素子を共通収納する共通収納溝が設けられており、前記各共通収納溝それぞれに前記各素子列の磁気抵抗素子それぞれが収納されている。
【００２５】本発明は、好ましくは、前記素子列で磁気抵抗素子の配列される方向と前記被検体の通過方向とが交わる所定角度は、直交ないしはほぼ直交する角度である。
【００２６】
【発明の実施の形態】以下、本発明の詳細を図面に示す実施の形態に基づいて説明する。
【００２７】図１ないし図４は、本発明の実施形態に係り、図１は、本実施の形態の磁気センサの斜視図、図２は、図１のＡ－Ａ線に沿う断面図、図３は、図１のＢ－Ｂ線に沿う断面図、図４は、磁気抵抗素子の平面図である。
【００２８】図１ないし図４を参照して、本実施の形態の磁気センサ１は、長尺型のケース２と、複数の磁気抵抗素子３…と、金属製カバー４と、バイアス用の永久磁石５とを有する。
【００２９】ケース２は、被検体としての磁気カード６が通過する方向に対して直交もしくはほぼ直交する方向（後述する配列方向）に長尺な形状を有する。ケース２の

一面には複数の磁気抵抗素子収納溝７が設けられ、この収納溝７にそれぞれ磁気抵抗素子３が収納固定される。この磁気抵抗素子収納溝７の深さは、磁気抵抗素子３の素子厚みより深くされている。

【００３０】ケース２の他面側には永久磁石収納溝８が設けられ、この収納溝８に単一の永久磁石５が収納固定される。

【００３１】ケース２の一面側は、金属製カバー４で覆われる。さらに、ケース２には複数の端子ピン９が貫通固定されている。

【００３２】この磁気抵抗素子３は、図４に示すように、内部に磁気感応部１０を有し、その磁気感応部１０の両端それぞれに接続電極を介して入出力用の端子１１，１３が接続され、前記両接続電極を中間接続する電極にも中間端子１２が接続され、各３本の端子１１，１２，１３が磁気抵抗素子３毎の検知方向片側に位置付けれられている。

【００３３】詳述すると、磁気感応部１０は、図４に示すように、２列の感磁部１４ａ，１４ｂが相対向する状態で設けられたものであって、一方の感磁部１４ａの両端には前記端子１１，１２がそれぞれ接続され、他方の感磁部１４ｂの一端には前記端子１３が接続され、他方の感磁部１４ｂの他端には前記端子１２が接続されている。

【００３４】そして、各端子１１，１２，１３に接続されるリード端子１６，１７，１８は、ケース２に設けられた前記端子ピン９にそれぞれ接続されている。

【００３５】これによって、この磁気センサ１は、複数の磁気抵抗素子３それぞれから被検体としての磁気カード６からの磁気情報の検知出力が個別に得られるようになっている。

【００３６】以上の構成において、本実施の形態では、次の構成に特徴を有する。すなわち、本実施の形態では、複数の磁気抵抗素子収納溝７が、磁気カード６の磁気センサ１に対する通過する方向に対して直交する方向に所定間隔へだてて２列にずらされて千鳥状に位置設定されて設けられている。そして、前記千鳥状において各列の磁気抵抗素子収納溝７は、磁気カード６が磁気センサ１の検知面上を通過する方向において以下の関係で重なるように設けられている。

【００３７】すなわち、図１および図２に示すように、各素子列の磁気抵抗素子収納溝７それぞれに磁気抵抗素子３が収納されていることにより、前記複数の磁気抵抗素子３は、それぞれ所定数の磁気抵抗素子でもって２つの素子列Ｓ１，Ｓ２に分けられ、各素子列Ｓ１，Ｓ２において一方の素子列Ｓ１における二つの磁気抵抗素子３，３それぞれの磁気感応部１０，１０に対して、他方の素子列Ｓ２における磁気抵抗素子３の磁気感応部１０が磁気カード６が磁気パターン１５の検出のため磁気センサ１を通過する方向（図２における矢印ａの示す方向）において重なる配列形態とされている。

【００３８】ここで、磁気抵抗素子１は、図４で示すように、所要の基板１９上に磁気感応部１０が前記所定方向に沿って形成されており、基板１９の前記所定方向における両端縁と磁気感応部１０の長手方向両端縁それぞれの間の領域が磁気不感応領域Ｌとなっている。また、各素子列内において所定方向において隣り合う磁気抵抗素子の両磁気感応部の対向距離は、被検体としての磁気カード６の検知長さ（つまり磁気パターン１５が設けられている範囲の長さ）以下に設定されている。ここで、磁気感応部１０は、磁気感応領域を示す。

【００３９】そのうえで、一方の素子列Ｓ１における二つの磁気抵抗素子３，３それぞれの磁気感応部１０，１０に対して、他方の素子列Ｓ２における磁気抵抗素子３の磁気感応部１０が磁気カード６の磁気センサ１を通過する方向において重なる配列形態とされている。

【００４０】したがって、本実施の形態に係る磁気センサ１の場合、磁気抵抗素子３が所定方向に隣り合って複数配置され、それらの磁気不感応領域により当該所定方向に大きな磁気不感応領域が形成されて、かつ、磁気カード６側で磁気パターン１５の配列間隔が変更されても、一方の素子列における二つの磁気抵抗素子それぞれの磁気感応部１０に対して、他方の素子列における磁気抵抗素子の磁気感応部１０が前記磁気カード６の通過方向に対して重なる配列形態により、磁気カード６の磁気パターン１５の通過する横幅範囲の全体において、その磁気パターン１５の検出不能な領域がないので、その磁気パターン１５を確実に精度良く検知できる。特に、各列Ｓ１，Ｓ２間の磁気感応部１０が重なる領域Ｌ’が検出パターン上にある場合でも、検知出力の低下や検知感度の低下を来たすようなことがない。

【００４１】また、前記各素子列Ｓ１，Ｓ２が磁気カード６の前記通過方向に対して所定距離ずらされて設けられているから、各素子列Ｓ１，Ｓ２の磁気抵抗素子３が同時に被検体を検知するクロストークが発生するようなことがなくなり、磁気パターン１５の検知を確実に行うことができるようになる。

【００４２】本発明は、上述の実施形態に限定されるものではなく、種々な応用や変形が考えられる。

【００４３】（１）上述の実施形態の場合、磁気抵抗素子収納溝は各磁気抵抗素子それぞれを個別に収納する個別収納溝であったが、図５で示すように、一方の素子列を構成する複数の磁気抵抗素子３を共通収納する共通収納溝２０と、前記他方の素子列を構成する複数の磁気抵抗素子３それぞれを共通収納する共通収納溝２１とが長手方向に所定距離位置ずれさせて設けられており、前記各共通収納溝２０，２１それぞれに前記各素子列Ｓ１，Ｓ２の磁気抵抗素子３それぞれが収納されているものでもよい。この場合、各素子列Ｓ１，Ｓ２において磁気抵抗素子３が隣合うもの同士がスペーサなどなく互いに当接

するように収納しているとともに、共通収納溝２０，２１がその長手方向で所定距離位置ずれしていることで、被検体が矢印ａ方向に移動して磁気検出のため磁気センサ１を通過していく際に、その通過方向で素子列Ｓ１の磁気抵抗素子３の磁気感応領域となる磁気感応部１０と、素子列Ｓ２の磁気抵抗素子３の磁気感応領域となる磁気感応部１０とが重なるため、磁気抵抗素子３が配列されている方向での被検体の通過領域において磁気検出できない領域はなくなり、精度良く磁気検出できる。

【００４４】（２）上述の実施形態の場合、磁気センサのケースは、長尺となっているが、これに限定される必要はなく、磁気抵抗素子を収納できるケースであればよい。

【００４５】（３）上述の実施形態の場合、磁気抵抗素子は、被検体の通過方向に対して直交する方向に配列されて素子列を構成しているが、その素子列の方向は被検体の通過方向に対して直交する必要は必ずしもなく、被検体の通過方向に対して斜めとなる所定の角度で交わるものでもよい。

【００４６】（４）上述の実施形態の場合、１つの磁気抵抗素子収納溝には１つの磁気抵抗素子が収納される形態となっているが、１つの磁気抵抗素子収納溝に１つの磁気抵抗素子を収納させる必要は必ずしもなく、例えば、図６で示すように、１つの磁気抵抗素子収納溝２２に複数の磁気抵抗素子３…を収納させるようにしてもよい。この場合、素子列Ｓ１，Ｓ２間、並びに、同じ素子列における隣合う磁気抵抗素子３間にはスペーサを介在させることになる。

【００４７】（５）上述の実施形態の場合、上記磁気センサ１に使用される各磁気抵抗素子３の磁気感応部１０は、例えば、図４で示すように、複数個の単位感磁部ｊを直列接続した状態で左右方向に並設して感磁体１４ａ，１４ｂを構成し、さらにこの感磁体１４ａ，１４ｂの一対を、前後に互いに所定間隔を隔てて基板１７上に形成したものを示したが、感磁体が横にひとつながりとなるように構成した磁気抵抗素子でも良い。

【００４８】（６）上述の実施形態の場合、被検体として、磁気カードについて示したが、磁気カードに限定されるものでなく、例えばスティック状の磁気記録媒体などでも良い。

【００４９】（７）上述の実施形態では、各素子列内において所定方向において隣り合う磁気抵抗素子の両磁気感応部の対向距離は、被検体としての磁気カード６の検知長さ以下に設定されているとしたが、必ずしもこのように設定する必要はなく、その対向距離が被検体の検知長さより長い場合も本願発明に含まれる。

【００５０】

【発明の効果】以上説明したように、本発明によれば、非検知エリアがなくなるため、例え、磁気パターンの配列変更があっても、磁気パターン検知感度を高められ、検出範囲の全範囲において磁気の読取が可能となる。また、クロストークが発生しないようにすることができる。

【図面の簡単な説明】

【図１】本発明の実施形態に係る磁気センサの斜視図

【図２】図１のＡ－Ａ線に沿う断面図

【図３】図１のＢ－Ｂ線に沿う断面図

【図４】磁気抵抗素子の平面図

【図５】本発明の他の実施形態に係る磁気センサの要部の平面図

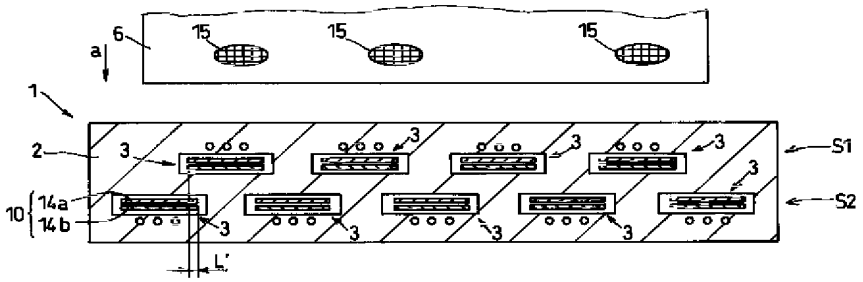
【図６】本発明の他の実施形態に係る磁気センサの要部の平面図

【図７】磁気カードと従来の磁気センサとの関係を示す図

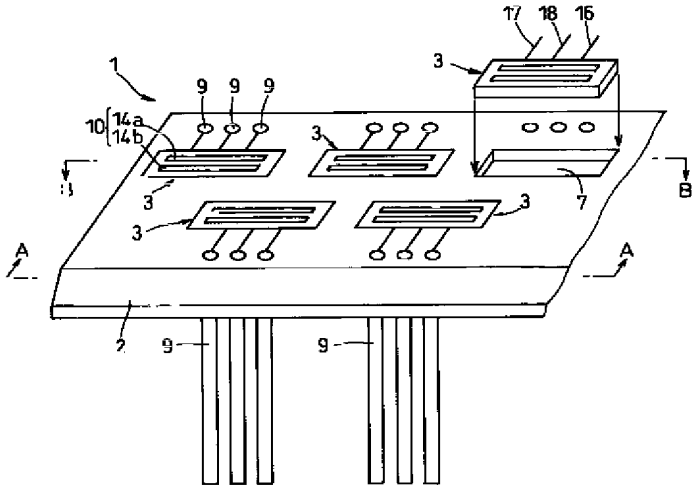
【符号の説明】

１　磁気センサ
３　磁気抵抗素子
６　磁気カード（被検体）
１０　磁気感応部（磁気感応領域）
１５　磁気パターン
Ｓ１，Ｓ２　素子列

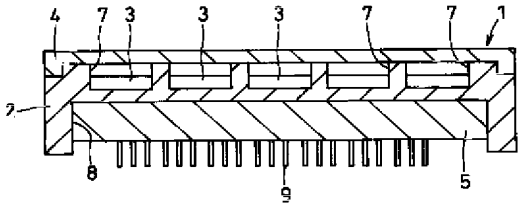
【図２】



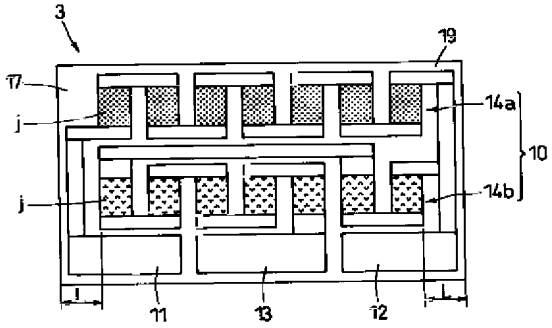
【図1】


17
18
16
1
9
9
9
3
10
14a
14b
3
3
3
3
7
B
A
A
2
9
9

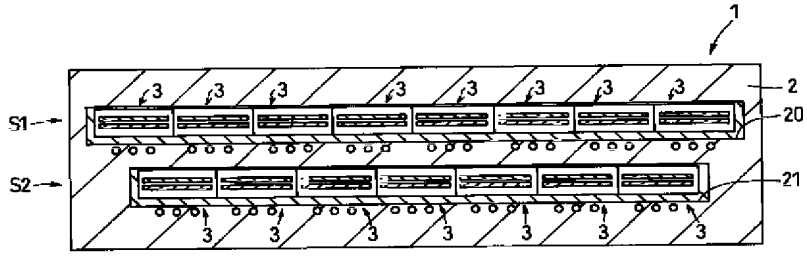
【図3】


4
7
3
3
3
7
7
1
2
8
9
5

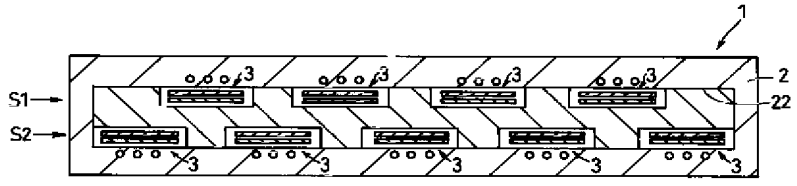
【図4】


3
19
17
j
14a
10
j
14b
l
11
13
12
l

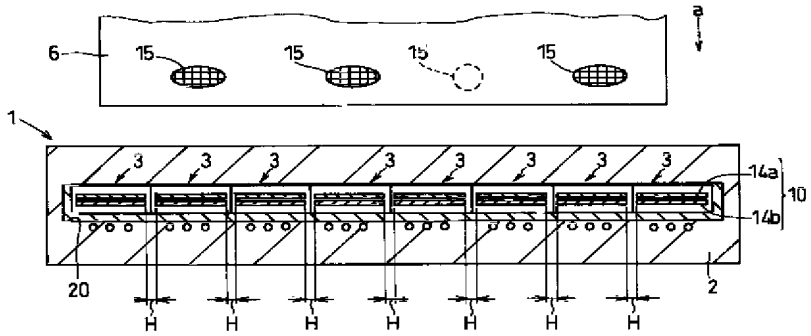
【図5】


1
3
3
3
3
3
3
3
3
2
S1
20
S2
21
3
3
3
3
3
3
3

【図6】


1
3
3
3
3
2
S1
22
S2
3
3
3
3
3

【図7】

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